REMARKS

This is in response to the non-final Official Action currently outstanding with regard to the present application.

Claims 26-43 were pending in this application at the time of the issuance of the currently outstanding Official Action. By the foregoing Amendment, Claims 26, 29 and 32 have been amended. Claims 1-25 previously were canceled, without prejudice, and Claim 36 was previously withdrawn. Accordingly, upon the entry of the foregoing amendment, Claims 26–35 and 37–43 as amended above will constitute the Claims under active prosecution in this application.

The Claims of this application are reproduced above including appropriate status identifiers and indications of the changes being made as required by the Rules.

More particularly, in the currently outstanding Official Action the Examiner has:

1. Failed to re-acknowledge Applicants' claim for foreign priority under 35 USC §119 (a)-(d) or (f), and reconfirm the receipt of the required copies of the priority documents by the United States Patent and Trademark Office – **the Examiner acknowledged and confirmed these filings earlier in this prosecution**;

2. Failed to provide Applicants with an indication concerning the acceptability of the drawings as filed with this application – **the Examiner indicated that the drawings filed on 7 July 2004 were accepted earlier in this prosecution**;

3. Failed to acknowledge his consideration of the Information Disclosure Statement filed in this application on 8 July 2005 by providing the Applicants with a copy of the Form PTO/SB/08a/b that accompanied that Statement duly signed, dated and initialed to confirm the consideration of the art listed therein – **appropriate acknowledgement of the Information Disclosure Statement filed on 8 July 2005 is respectfully requested**;

4. Indicated that Applicants' Request for Continued Examination has been entered;

5. Rejected Claim 26-28, 30-35, 37-38, 40-41 and 43 under 35 USC §103(a) as being unpatentable over Welch (U.S. Patent No. 5,903,373) in view of Ota (U.S. Patent No. 5,986,790);

6. Rejected Claims 33, 34 and 35 under 35 USC 103(a) as being unpatentable over Welch (U.S. Patent No. 5,903,373) in view of Ota (U.S. Patent No. 5,986,790) as applied to Claim 32, and further in view of Knapp (U.S. Patent 4,975,926) and Sumi et al (U.S. Patent 4,536,057); and

7. Indicated that Claims 29, 39 and 42 are objected to as being dependent upon a rejected base claim, but that those claims would be allowable if rewritten in independent form including all of the limitations of their respective base claims and any intervening claims.

No further comment regarding items 1-4 above is deemed to be required in these Remarks.

Also, without prejudice to their right to do so at a later date if then deemed appropriate, Applicants respectfully presently decline the Examiner's offer to allow Claims 29, 39 and 42 if those Claims are rewritten in independent form including all of the limitations of their respective base claims and any intervening claims in view of the foregoing Amendment and the following Remarks.

With respect to items 5 and 6, Applicants note that the Examiner has maintained his previous rejections in view of his continued belief that the cited references meet the limitations of the claims of this application as they stood prior to the foregoing Amendment on the bases that:

1. In the Welch reference, each distinct signal emitted from the transmitter is transmitted over a separate physical path in space thereby meeting the accepted definition of "space division multiplexing";

2. the term "space division multiplexing" cannot be given any patentable weight because it merely constitutes a recitation of purpose or intended use and the body of the claim does not depend on that term for completeness; and

3. the recitation of intended use is deemed not to result in a structural difference between the claimed invention and the prior art that patentably distinguishes the claimed invention from the prior art.

In considering the Examiner's position, Applicants have concluded that the differences of opinion between the Examiner and Applicant that have given rise to the continued rejections of the claims of this application in the currently outstanding Official Action may be the result of Applicants' failure to fully, clearly and distinctly state the subject matter that they regard as their invention in the claims. In this regard, Applicant apparently incorrectly believed that the previous Amendment in this application overcame their previous reliance upon the inherent meaning of the phraseology used in the claims of this application.

In view of the foregoing, Applicant now has amended Claim 29 so as to make a minor change in the phraseology thereof, and also has amended the independent claims of this application (Claims 26 and 32) so as to clearly, definitely and distinctly indicate that the present invention is directed to the ***simultaneous interconnection of more than one of a plurality of terminals making up a wireless local area network with at least one other terminal of that wireless local area network, each via at least one separate space cell.*** Further, Applicant now has also amended the independent claims of this application so as to more clearly and distinctly define the structure that allows these goals (purposes) of the present invention to be attained. No new matter has been added to this application by virtue of the foregoing amendments. (See, present specification at Page 8, line 21 to Page 9, line 5; Page 9, lines 18-23; Page 30, lines 12-21; Page 35, line 14 – Page 36, line 13; Page 42, lines 1-15; and Page 47, lines 2-23 indicating that the present invention is to simultaneously interconnect multiple terminals to a base station)

Hence, Applicant respectfully requests that this application be allowed in view of the foregoing Amendment and the Examiner's reconsideration of the following summary of Applicant's previous discussion of the differences between the present invention and the cited art relied upon by the Examiner in the distinctly clarified context provided by the foregoing Amendment.

More Particularly, Applicant respectfully submits that the foregoing amendments to the independent claims of this application will allow the Examiner to fully understand the distinctions between space-division multiplexing as disclosed and claimed in this application, as distinguished from space division combined with multiplexing in time domains as disclosed in the art that he has relied upon in support of the currently outstanding rejections of the claims of this application. Specifically, Applicant respectfully notes that the Examiner's continued assertion in the currently outstanding Official Action that the Welch reference obviously discloses a base station for use in a space-division multiplex optical wireless network (i.e., communication channels multiplexed in terms of space) because Welch discloses multi-frequency channels and a receiver that is an angularly diverse detector cannot stand in the face of the foregoing amendment. This is because the Examiner's previous conclusion that Welsh discloses "communication channels multiplexed in terms of space" fails to take appropriate notice of the fact that the Welch reference discloses a ***sequentially operated system*** while the present invention is directed to a ***simultaneously operated system***. Accordingly, while the Welch reference may disclose space division, it does not disclose plural communication channels between multiple terminals and a base station simultaneously multiplexed in terms of space. Applicant respectfully submits that this previously inherent and now explicit distinction between the Welch reference and the present invention is not simply one of semantics. Rather, it is a substantive distinction that differentiates the present invention from the art relied upon by the Examiner.

Thus, once it is understood that the present invention is claiming a ***simultaneous*** process while Welch disclosed a ***sequential*** process, it becomes clear that even if one converts the multiplexing in time domains discussed in detail by the Welch reference into a "true" multiplexing of those time domain signals, diversity by space division as herein now disclosed and claimed remains different from space-division multiplexing. As previously noted, Welch contemplates a single cell and whether that cell is represented at the base station as a time sequence of signals differing only in SNR or as signals multiplexed in parallel that differ only in SNR, the result remains the same, namely, Welch is ***sequentially*** processing signals based on diversity by space division of single cells, while the present invention is processing signals based upon space-division multiplexing on the basis of a plurality of cells ***simultaneously***.

Reconsideration of Applicant's previous line of argument in view of the foregoing observations and amendments, therefore, is believed to be appropriate at this stage of the present prosecution.

It is generally understood by those of ordinary skill in the art that the term "multiplexing" means that a plurality of terminals can perform communication at the same time by using a plurality of channels. It is to be understood in this regard, however, that multiplexing by space-division (the present invention) and multiplexing in time domains (Welch) are significantly different from one another. Therefore, it will be seen that in the Welch reference the structure (for example, an arrangement of detectors in the case of a receiver) provides only a spatial communication channel irrespective of whether space-division is performed or not. In other words, Welch is not concerned with the simultaneous communication of multiple terminals with the base station at the same time. Thus, the manner in which each terminal communicates with the base station individually during each time interval does not render the present invention that deals with simultaneous communication between multiple terminals and the base station in any way obvious to one of ordinary skill in the art.

Accordingly, it is to be understood that in the Welch reference, the multiplexing of a channel for handling a plurality of terminals is performed in a time series. This is clear because the features disclosed in Welch indicate that polling of a channel is performed, and an uplink and a downlink are arranged in a time series within a single frame as shown in Fig. 3. ***Consequently, Welch teaches, discloses and/or suggests that the number of remote terminals that can exchange information with a base station at a certain time without error is always at the maximum one as alleged hereinabove***.

Applicant respectfully submits, therefore, that since multiplexing is performed in a time domain in Welch, the communication protocol disclosed thereby is limited to that set forth above. On the other hand, however, in the case of a plurality of space-division multiplexed channels such as in the present invention, each of the space channels is substantially the same as a one-to-one communication channel with a base station for a remote terminal. Accordingly, in the present invention, unlike Welch, full use of a communication band of the remote terminal can be made. Similarly, the present invention provides the advantage that a number that equals the number of channels can perform communications in parallel at the same time. This inherent feature of the present invention as previously claimed is now made more explicit by the foregoing Amendment as the Examiner implicitly has suggested to be necessary in his comments concerning the previous amendment in this application in the currently outstanding Official Action.

The Examiner's currently outstanding rejection again asserts that (1) the remote terminal of Welch comprises a receiver of an angle diversity type (Fig. 11) and a multi-beam transmitter for outputting a plurality of beams (Fig. 10), (2) the Welch base station comprises a multi-beam transmitter for outputting a plurality of beams (Fig. 14), and (3) the Welch multi-beam transmitter includes a plurality of transmitters that each include at least one LD or LED as a light source. (Note: Figs. 10 and 11 of Welch show a remote terminal, not a base station. These showings, however, are regarded as the same herein for explanation purposes because such a remote terminal can be applied to the base station in the context of the present invention.) However, space-division as disclosed by Welch only includes angle diversity for the purpose of improving the SNR of a particular channel.

Hence, on the receiver side, the parallel reception signals outputted from a plurality of detectors 109 or 135 as shown in Figs. 11 or 14 are the transmission signals transmitted from a single transmission terminal according to a communication protocol calculated to avoid collisions between (among) a plurality of transmission data. Therefore, the received signals in Welch are different only with respect to their SNR or an influence of multi-path reflection. Further, one of the plurality of reception signals is selected or the signals are combined such that there is only one spatial communication channel disclosed.

In the present invention, on the other hand, each remote terminal substantially performs one-to-one communication with a base station. Consequently, it is not necessary to utilize the Welch communication protocol in order to achieve the now specifically claimed multiple connections. In addition, the disadvantage that the communication band of the remote terminal is not fully utilized does not occur in the present invention as it does in Welch. Instead, the present invention utilizes the concept of a space cell for multiplexing. Unlike Welch, this results in a dead zone boundary region between the space cells becoming an important technical problem the solution of which is tied to the structure of the base station. ***In other words, in Welch, the whole of space is logically a single space cell whether space-division is performed or not. Therefore, in Welch, there is no concept or recognition of a space cell as an individual channel that is spatially multiplexed***. Consequently, Welch does not contemplate a system including boundaries between spatially divided regions resulting in dead zones that must be accounted for in the structure and operation of the system.

Indeed, in the Welch reference, as is clearly shown in Figs. 10 and 11, space-divisions for transmission and reception do not have to correspond to each other at all. Instead, it is sufficient if a wide angle region is covered as a whole. In this regard, Applicant recognizes that in the base station of Welch shown in Fig. 14, space is divided in three directions in order to divide transmission/reception.

It is to be understood, however, that in this case, as shown in Welch Fig. 21 (and at "AVERAGING DIVIDE BY THREE" in the circuit diagram of Welch Fig. 15) the three signals are each composed of the same transmission data as that which otherwise would be received from only one terminal. The three signals are sent out using the transmission protocol discussed above that is used to avoid transmission data collisions such that they differ only in terms of SNR or an influence of multi-path reflection. Again, since in Welch the plurality of reception signals are combined and only one space cell of the whole of space exists, the latter mode of operation is respectfully submitted to be no different in terms of the form of communication than one space cell that is shared by a plurality of remote terminals by a protocol.

Therefore, it will be recognized (as now has been made more explicit by the foregoing amendment) that in systems utilizing multi-beam transmitters and an angle diversity type receivers, there are distinctive differences in structure and channel operation between systems using diversity by space division and systems using space-division multiplexing.

In the currently outstanding Official Action, the Examiner also has again asserted that Ota discloses a concept of a space cell in Figs. 22 and 23 such that the present invention would have been obvious over the combination of Welch and Ota. (These figures, similarly to Figs. 10 and 11 of Welch, illustrate a transmitter/receiver of the remote terminal. They are regarded as the same herein for explanation purposes since such a remote terminal can be applied to the base station of the present application.)

In Ota, as shown in Fig. 22B and Col. 16, lines 9-12, one of seven cells is selected by manipulating the lens 175 during either transmission or reception. ***This means that only one spatial channel is formed, and indicates that it is impossible to cause them to operate independently***.

Consequently, as described by Ota at Col. 16, line 62 to Col. 17, line 11, with respect to the vertical direction, that reference tries to reduce the transmission power of remote terminals by using spatial diversity, rather than by the provision of space-division multiplexing. In addition, at Col. 17, lines 11-13, with respect to a horizontal direction, Ota makes it evident that the remote terminal itself determines the timing of the handover between spatial cells provided by different base stations 121a and 121b by the use of spatial diversity. This is another indication that Ota does not assume the multiplexing of channels by space division in a single communication area.

Accordingly, Applicant respectfully submits that with regard to the difference between space division and space-division multiplexing, Welch and Ota are in the same category. In fact, even though the system of Welch is improved in comparison to the system of Ota, the same space-division multiplexing system as that of the present invention cannot be achieved by either of them. More specifically, neither the system of Ota, nor the system of Welch, provides for space-division multiplexing at least on the following two points:

First, as shown by Fig. 23 of Ota, in the Ota reference there are a plurality of transmission/receiving elements into the number of which the communication area is spatially divided. Thus, as described at Col. 15, lines 64-66, only one transmitting element 173 or receiving element 174 corresponds to one of the space cells, and it has a single light emitting element such as an LED or an LD or a single PIN-PD. In other words, the concept of assigning one or more light emitting elements or light receiving elements for grouping is not disclosed.

On the other hand, however, it is a feature of the base station of the present invention that there are at least one or more elements for each of the space cells. Applicant respectfully submits that this feature has been inherent in the claims via the use of the term "angle-diversity receiver" in conjunction with the use of the terms "space-division multiplexing" and "so as to form a plurality of space cells" when read in light of the specification throughout this prosecution. In any event, Applicant respectfully submits that entry of the foregoing Amendment places this feature distinctly and explicitly in the Claims as the Examiner's comments implicitly appear to suggest is necessary for the appropriate delineation of the limitations of the present claims.

Accordingly, using the Ota reference as a basic context, it will be understood that the present invention differs from the Ota reference in that in the present invention there would be one or more of the transmitting elements 173 and of the receiving elements 174 for each of the space cells 112a-g as depicted in Fig, 24. In other words, in the present invention the total number of groups of transmitting/receiving elements is the number of space cells that can be independently operated in parallel contrary to the teachings, disclosures and/or suggestions of the Ota reference. Consequently, the above-described differences are based on whether the system is provided for space-division multiplexing or not, and those differences lead to decisive distinctions regarding the structure and operational capabilities thereof for space resolution.

In addition, in Fig. 23 of Ota, as was the case in the Welch reference, there is an excessive dead zone between the elements 173 and 174 disclosed in the Ota reference. This dead zone, which is located in space between the space cells formed by the respective elements disclosed by Ota, cannot be used for communication. Furthermore, a serious problem tends to occur when the space cells actually formed in space overlap excessively. In that case, when space multiplexing is performed (adjacent cells are operated in parallel) co-channel interference (CCI) inevitably occurs. Neither the Welch, nor the Ota, reference addresses this problem. The reason for this appears to be that in the Welch and Ota systems, either a single space cell is selected or a plurality of signals that are the same are transmitted and thereafter combined into one. Accordingly, the Ota or Welch references may accurately be construed as disclosing, teaching or suggesting a transmitter or a receiver combination wherein only a diversity gain by space-division is contemplated or accomplished.

On the other hand, a major problem addressed by the present invention is the sufficient suppression of co-channel interference specific to the space-division multiplexing system. This phenomenon is not a problem in systems such as those disclosed by Welsh or Ota that only perform spatial diversity.

In addition, other problems addressed by the present invention include the maintenance of a high throughput without burdening the remote terminals, and the implementation of the whole system at low cost. Therefore, it will be seen that in the present invention, multiplexing of channels by space-division is a prerequisite to the successful accomplishment of its objectives. The logical consequence of this is that the problems solved by the present invention in comparison with those solved by the Ota and Welch references are quite different from one another, a fact that in and of itself is an indication of the failure of the cited references (whether taken alone or in combination with one another) to adversely impact upon the patentabiltity of the present claims.

One such problem is represented by the term "predetermined size" used with the term "space-division multiplexing" as in Claim 26 of the present application. The Examiner suggests that Ota discloses the concept of a space cell in Figure 22B and that the control of the size of that space cell is merely a matter of design choice achieved by such expedients as increasing the number of transmitters and enhancing transmission light power.

Applicant respectfully submits, however, that it should be recognized that it may be necessary to individually control the directions of axes of the respective space cells (i.e., the angles of optical axes of the respective transmitting/receiving elements) only if it is assumed that a plurality of the space cells operate in parallel. This is important in light of the fact that unlike the cited art, a basic objective of space-division multiplexing is to accommodate only one remote terminal (or one user) in one space cell, thereby making the uniformity of the size of the respective cells produced by the base stations across the entire area covered by the base stations important. In addition, in order to meet this inevitable system requirement for space-division multiplexing systems, the control of the axial directions of the space cells is an essential feature.

This is to be contrasted with systems such as Welch or Ota in which only spatial diversity is the objective, and it is not necessary to finely control the angles of the axes of the transmitting/receiving elements. Accordingly, in the prior art systems, it is sufficient if the system is designed to perform space-division (in the most simple case, equal division) in an angle region and to simply maximize the transmission power to individually divided space cells. Significantly, it is respectfully noted that neither Welch nor Ota describe the diameter of their space cell because that diameter does not have to be defined in the systems disclosed by them.

In view of the foregoing Amendment and Remarks, Applicant further respectfully submits that the dependent claims of this application not only are allowable because the independent claims upon which they respectively depend are now in condition for allowance, but also that as was previously explained in this prosecution, those claims also add further support to the distinctions now explicitly included in the claims of this application over the disclosures of the art relied upon by the Examiner in his rejections. Repetition of those comment in this response is deemed to be unnecessary in view of the preceding discussion of Applicant's previous comments concerning the independent claims of this application in the context of the restatement of the inherent features of the present invention in clarified and more distinctive and explicit terms in the foregoing Amendment.

For each and all of the foregoing reasons, and in light of the foregoing Amendment, Applicant respectfully submits that the distinctions between space-division multiplexing on the one hand and space division with time domain multiplexing on the other hand, along with the ramifications of each as discussed above, clearly and convincingly indicate that the Examiner's currently outstanding rejections should be withdrawn. Further, Applicant respectfully submits that the entry of the foregoing Amendment will not introduce any so-called new matter into this application. Therefore, Applicant respectfully submits that the claims as they will stand upon the entry to the foregoing Amendment now are in condition for allowance. A decision so holding in response to this communication is respectfully requested.

Applicant also believes that additional fees beyond those submitted herewith are not required in connection with the consideration of this response to the currently outstanding Official Action. However, if for any reason a fee is required, a fee paid is inadequate or credit is owed for any excess fee paid, you are hereby authorized and requested to charge and/or credit Deposit Account No. 04-1105, as necessary, for the correct payment of all fees which may be due in connection with the filing and consideration of this communication.

Respectfully submitted,

Date: September 26, 2005

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